

Claims 1, 2, 5-11, 15 and 18 have been rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent 5,591,958 (Nishi et al.). With regard to the claims as amended, this rejection is respectfully traversed.

Independent Claim 1 as amended by this amendment is directed to scan type exposure apparatus in which a pattern of an original is lithographically transferred to a substrate sequentially while the original and the substrate are scanningly moved relative to exposure light. In the apparatus, a photodetector disposed in an illumination optical system at a position optically conjugate with the original detects the quantity of light illuminating the original. Correction information with respect to the photodetector output in relation to different positions of the original to be illuminated with exposure light is stored. A correction device receives stored correction information and corrects, in the lithographic transfer, the output of the photodetector by use of the stored correction information.

Independent Claim 6 as amended by this amendment is directed to an exposure system in which an illumination optical system illuminates an original with exposure light output from a light source. A projection optical system projects a pattern of the original illuminated by the illumination optical system onto a substrate. A photodetector disposed in the illumination optical system at a position optically conjugate with the original detects the quantity of light illuminating the original. A control unit controls the exposure light output from the light source on the basis of the output of the photodetector and a correcting unit reduces the influence of reflection light from the original on the basis of the output of the photodetector as the original is illuminated by illumination optical system.

In Applicant's view, Nishi et al. discloses exposure apparatus that transfers a pattern formed on a mask to a photosensitive substrate. The apparatus is provided with an illumination optical system to illuminate a local area on the mask with a light beam. A projection optical system projects the pattern of the mask to the photosensitive substrate and a relative scanning device relatively scans the mask and the photosensitive substrate in a perpendicular direction to the optical axis of the projection optical system to transfer the pattern of the mask to the photosensitive substrate. An adjusting device adjusts at least one of the scanning speeds of the mask and substrate, the intensity of the light beam to be incident on the photosensitive substrate and the width of a projection area of the pattern of the mask by the projection optical system in the relative scanning direction in accordance with the change of the sensitivity characteristic of the photosensitive substrate or the change of the intensity distribution of the light beam passing a Fourier transform plane in the illumination optical system with respect to the pattern surface of the mask.

According to the invention defined in Claims 1 and 6 as amended by this amendment, a photodetector in an illumination optical system is disposed at an optically conjugate with the original to detect the quantity of light illuminating the original. In Claim 1, correction information is stored with respect to the photodetector output in relation to different positions of the original to be illuminated and the output of the photodetector is corrected during lithographic transfer using the stored correction information. In Claim 6, the exposure light is controlled on the basis of the photodetector detecting the quantity of light illuminating the

original and the influence of reflection light from the original is reduced based on the output of the photodetector as the original is illuminated.

Nishi et al. may teach the use of a photodetector 54 to measure the reflected light from the reticle 12 and the wafer 5. As disclosed at lines 23 to 28 of column 11 of Nishi et al., "The output value of the refractivity monitor 54 obtained, provided that the reflected light from the wafer 5 will not return to the reflectivity monitor 54, corresponds to the intensity of the reflected light from the reticle 12. Therefore, when this output value is obtained in advance and when the obtained output value is subtracted from the value output from the refractivity monitor 54 in the state that the wafer 5 is positioned under the projection optical system 8, a value corresponding to the intensity of the reflected light from the wafer 5 is calculated." As disclosed, it is clear that the photodetector 54 only measures light reflected from the reticle 12.

It is a feature of Claims 1 and 6 that a photodetector detects the quantity of light illuminating the original. As clearly shown in Fig. 1 of the subject application, the photodetector that detects the quantity of light illuminating the original corresponds to photodetector 39 in Fig. 1 of the subject application which receives a portion of the light that illuminates the reticle from the mirror 38 but could not possibly measure light reflected from the original. As a result, it is not seen that Nishi et al.'s reflectivity photodetector that only measures light reflected from the reticle could possibly teach or suggest a photodetector that detects the quantity of light illuminating the original as in Claims 1 and 6. It is further not seen that Nishi et al.'s reflection correction based on reflectivity photodetector measurements could suggest

reduction of the influence of reflection light on the basis of the output of the photodetector that detects the quantity of light illuminating the original as in Claim 6.

It is a further feature of Claims 1 and 6 that the photodetector measuring the light illuminating the original is optically conjugate with the original. Nishi et al. fails in any manner to disclose anything about the positional relationship between the reflectivity photodetector 54 and the reticle 12 and is devoid of any suggestion that the reflectivity photodetector 54 is conjugate with the reticle 12. It is clearly seen from Fig. 1 of Nishi et al. that the reflectivity photodetector 54 is not in a conjugate relationship with the reticle 12. In other embodiments, Nishi et al. clearly teaches that the reticle is placed conjugate with the wafer. With such a conjugate relationship between the reticle and the wafer in Fig. 1, there could be no conjugate relationship between the reflectivity photodetector 54 and the reticle 12.

Further, Nishi et al. requires measurement of reflected light of the wafer surface as a whole and fails to teach or suggest the feature of Claims 1 and 6 of storing correction information in relation to different positions of the original to be illuminated. Accordingly, it is not seen that Nishi et al. in any manner teaches or suggests the features of Claims 1 and 6. In at least these respects, it is believed that Claims 1 and 6 are completely distinguished from Nishi et al. and are allowable.

Pending independent Claim 5 is directed to exposure apparatus that lithographically transfers a pattern of an original onto a substrate. In the apparatus, a first photodetector disposed at a position optically conjugate with the original detects information regarding the original and produces an output. A second photodetector detects reflection light

from the original and produces an output. Correction information with respect to the output of the first photodetector in relation to different positions of the original is stored on the basis of the outputs of the first and second photodetectors. A correction device receives the stored correction information and corrects, in the lithographic transfer, the output of the first photodetector using the correction information.

It is a feature of Claim 5 that correction information with respect to the output of a first original information detecting photodetector is stored on the basis of the outputs of the first photodetector and the second (reflection light detecting) photodetector. As discussed with respect to Claims 1 and 6, the reflectivity photodetector 54 of Nishi et al. only detects reflection light from the reticle 12. Correction information in Nishi et al., however, is not produced on the basis of the output of the reflectivity photodetector 54. Rather, as disclosed at lines 38 through 67 of column 11 of Nishi et al., the correction information for the photodetector output is produced by a light amount monitor 58 positioned on the wafer stage. The reticle stage speed in Nishi et al. is changed during scanning exposure on the basis of measurement by the light amount monitor 58 and the width of the reticle blinds are changed when the reticle speed is changed and when the luminance Q changes during exposure to control exposure amount. These changes are made to maintain the exposure amount constant but are unrelated to controlling with respect to reticle reflection light as in the present invention. As a result, it is not seen that Nishi et al. in any manner teaches or suggests the use of the reflectivity photodetector 54 that detects reflection light to produce correction information for a first photodetector as in Claim 5. Further, as discussed with respect to Claims 1 and 6, there is no suggestion in Nishi et al. that reflectivity

photodetector 54 or integrator sensor 46 are optically conjugate with the original. It is therefore believed that pending Claim 5 is completely distinguished from Nishi et al. and is allowable.

Newly added independent Claim 19 is directed to a scan type exposure apparatus in which a pattern of an original is lithographically transferred to a substrate sequentially while the original and the substrate are scanningly moved relative to exposure light. In the apparatus, a photodetector disposed in an illumination optical system detects the quantity of light illuminating the original. Correction information with respect to the output of the photodetector in relation to different positions of the original to be illuminated with the exposure light is stored. A correction device receives the stored information and corrects, in the lithographic transfer, the output of the photodetector using the stored information.

In accordance with the invention of newly added Claims 19, a photodetector disposed in an illumination optical system detects the quantity of light illuminating an original. Correction information with respect to the output of the photodetector in relation to different positions of the original to be illuminated is stored and a correction device corrects the output of the photodetector using the stored information.

It is a feature of Claim 19 that the output of a photodetector detects the quantity of light illuminating an original and that information with respect to the photodetector output is used to correct the output of the photodetector in a lithographic transfer. As discussed with respect to Claim 1, the photodetector that detects the quantity of light illuminating the original corresponds to photodetector 39 in Fig. 1 of the subject application which receives a portion of the light that illuminates the reticle from the mirror 38 but could not possibly measure light

reflected from the original. Nishi et al. only teaches that reflection light is measured by a reflectivity photodetector 54 without a wafer in place and that the measurement result from the reflectivity measurement is used to control the amount of exposure. There is, however, no teaching or suggestion in Nishi et al. of detecting the quantity of light illuminating the original by a photodetector, storing correction information of the photodetector output at different positions of the original and correcting the output of the light quantity detecting photodetector using the stored correction information as in Claim 19. It is not seen that Nishi et al.'s reflectivity photodetector measurements could possibly teach or suggest correction information based on measurements of a photodetector that detects the quantity of light illuminating the original rather than reflected light from the original. It is therefore believed that newly added Claim 19 is completely distinguished from Nishi et al. and is allowable.

Newly added independent Claim 22 is directed to an exposure apparatus in which an illumination optical system illuminates an original with exposure light output from a light source and a projection optical system projects a pattern of the original illuminated by the illumination optical system onto a substrate. A photodetector disposed in the illumination optical system detects the quantity of light illuminating the original and a correction unit reduces the influence of reflection light from the original on the basis of the photodetector output as the original is illuminated by the illuminating optical system.

In accordance with the invention of newly added Claim 22, a photodetector disposed in an illumination optical system detects the quantity of light illuminating an original. Exposure light output of a light source is controlled on the basis of the photodetector output and

the influence of reflection light from the original is reduced on the basis of the output of the photodetector as the original is illuminated.

Nishi et al. only teaches obtaining an output value of a reflectivity monitor 54 without any reflected light from a wafer 5 which corresponds to the intensity of reflected light. As discussed with respect to Claim 6, it is a feature of newly added Claim 22 that a photodetector disposed in an illumination optical system detects the quantity of light illuminating the original (photodetector 39 in Fig. 1 of the subject application). It is another feature of Claim 22 that the influence of reflection light from the original is reduced on the basis of the output of the quantity of light detecting photodetector as the original is illuminated by the illumination optical system. It is not seen that the reflection intensity measurement by Nishi et al.'s reflectivity photodetector 54 could possibly suggest the use of the outputs of a light quantity detecting photodetector to reduce the influence of reflection light from the original as the original is illuminated. Accordingly, it is believed that newly added Claim 22 is completely distinguished from Nishi et al. and is allowable.

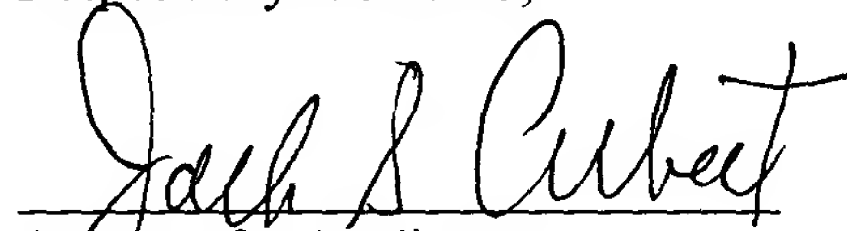
A review of the other art of record has failed to reveal anything which, in Applicant's opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record. Applicant's submit that the amendments to independent Claims 1 and 6 and the addition of independent Claims 19 and 22 clarify Applicant's invention and serve to reduce any issues for appeal.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration or reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicant respectfully requests favorable consideration and reconsideration and early passage to issue of the present application. The Examiner is respectfully requested to enter this Amendment After Final Action under 37 C.F.R. § 1.116.

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Respectfully submitted,



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APPENDIX A

IN THE CLAIMS

1. (Twice Amended) A scan type exposure apparatus wherein a pattern of an original is lithographically transferred to a substrate sequentially while the original and the substrate are scanningly moved relative to exposure light, said apparatus comprising:

[a photodetector, disposed at a position optically conjugate with the original, for detecting information regarding the original and for producing an output] a photodetector disposed in an illumination optical system and at a position optically conjugate with the original, for detecting a quantity of light illuminating the original;

storing means for storing correction information with respect to the output of said photodetector, in relation to different positions of the original to be illuminated with the exposure light; and

a correction device for receiving correction information stored in said storage means and correcting, in the lithographic pattern transfer, the output of said photodetector by use of the stored correction information.

6. (Twice Amended) An exposure apparatus, comprising:

an illumination optical system for illuminating an original with exposure light output from a light source;

a projection optical system for projecting a pattern of the original, illuminated by the illumination optical system, onto a substrate;

[a photodetector, disposed at a position optically conjugate with the original, for detecting information regarding the original and for producing an output] a photodetector disposed in said illumination optical system and at a position optically conjugate with the original, for detecting a quantity of light illuminating the original;

control means for controlling the exposure light output from the light source on the basis of the output of the photodetector; and

correcting means for reducing an influence of reflection light from the original, on the basis of the output of the photodetector as the original is illuminated by the illumination optical system.